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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

March 2, 1999

VIA HAND DELIVERY

Ms. Magalie R. Salas
Secretary
Federal Communications Commission
The Portals, 445 Twelfth Street, S.W.
Washington, D.C.

Re: ET Docket No. 98-206, RM-9147, RM-9245

Dear Ms. Salas:

Enclosed please find for filing on behalf of EchoStar Communications Corporation ("EchoStar") an original and eight copies of EchoStar's Comments in the above-referenced proceeding. Pursuant to the Commission's request, EchoStar submits these Comments in both hard copy and on computer disk.

Also enclosed is an additional copy of EchoStar's Comments, which we ask you to date stamp and return with our messenger.

Respectfully submitted,

Colleen Sechrest

Philip L. Malet
Colleen A. Sechrest

Enclosures

No. of Copies rec'd 0+8
List ABCDE

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matters of	
Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range	ET Docket No. 98-206 RM-9147 RM-9245
and	
Amendment of the Commission's Rules to Authorize Subsidiary Terrestrial Use of the 12.2-12.7 GHz Band by Direct Broadcast Satellite Licensees and Their Affiliates	

COMMENTS OF ECHOSTAR COMMUNICATIONS CORPORATION

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Counsel for EchoStar Communications Corporation

Dated: March 2, 1999

SUMMARY

EchoStar Communications Corporation ("EchoStar") hereby submits its Comments on the above-captioned proposals (1) to permit non-geostationary satellite orbit ("NGSO") Fixed-Satellite Service ("FSS") operations in certain segments of the Ku-band, including the 11.7-12.7 GHz band, the 14.0-14.5 GHz bands, and the 17.3-17.8 GHz band; and (2) to permit terrestrial use of the 12.2-12.7 GHz band for the retransmission of local television and the provision of one-way data services on a secondary basis by Direct Broadcast Satellite ("DBS") service operators and their affiliates. These proposals correspond to petitions for rulemakings filed by SkyBridge, L.L.C. ("SkyBridge") and Northpoint Technology ("Northpoint"), respectively. Absent appropriate technical constraints on the proposed NGSO services, beyond those already proposed by the Commission, the proposed allocation would compromise and could significantly interfere with existing DBS and FSS services in the Ku-band, and accordingly, should not be approved at this time. Furthermore, the Commission should not allocate the DBS spectrum to a ubiquitous terrestrial service.

The 12.2-12.7 and 17.3.-17.8 GHz bands are allocated domestically and in Region 2 to the Broadcasting Satellite Service ("BSS") for the provision of DBS services and their associated feederlinks, such as those provided by EchoStar. The 11.7-12.2 and 14.0-14.5 GHz bands are also allocated to the FSS, for which EchoStar also holds licenses. The importance of these services cannot be underestimated. In particular, with over six million subscribers in the United States today using the DBS bands, as the Commission recognizes, DBS is the closest competitor to cable television for the provision of multichannel video program distribution services. Accordingly, it is vital that the Commission protect both the current and future operation of these services. However, neither of the proposals made in this proceeding provide

adequate interference protection to existing and proposed satellite services in the United States that are already allocated in these bands.

First, while EchoStar does not object, in principle, to NGSO FSS operations in the Ku-band under appropriate technical criteria, the provisional power limits adopted at WRC-97 are insufficient to provide DBS operations in the United States with the protection they require. Most significantly, these limits on NGSO FSS systems would still permit unacceptable interference with both the widely-deployed 45 cm DBS receivers and the larger dishes used by EchoStar. Such interference would be particularly acute in an environment characterized by multiple NGSO FSS systems.

Equally significant, the proposed power limits would hinder DBS operators' plans to deploy a number of service innovations, including EchoStar's planned "double-feed" dish capable of receiving signals from satellites at two separate orbital locations. In light of these concerns, which are compounded exponentially by the presence of several millions of consumer receive dishes in the DBS downlink band, it would not be advisable to allow any NGSO FSS systems in that band absent adequate sharing criteria. EchoStar similarly questions whether the WRC-97 provisional power limits for NGSO FSS systems are sufficient to protect existing and future FSS systems deployed in the 11.7-12.2 and 14.0-14.5 GHz bands.

In addition, EchoStar agrees with the Commission's decision not to allocate the 17.3-17.8 GHz band to NGSO FSS service – operations which would jeopardize the flexibility and reliability of future DBS deployment in this band.

In short, EchoStar urges the Commission to permit NGSO FSS systems to operate in the Ku-band only if it can be demonstrated conclusively that existing and future DBS and FSS operations are fully protected by the established power limits. Moreover, the Commission

should require any NGSO FSS system that in practice exceeds established limits to cease operations immediately or reduce its signal levels so that the single-entity and aggregate limits are met. In addition, EchoStar urges the Commission not to allow NGSO FSS operations in the 17.3-17.8 GHz band under any circumstances.

Second, despite its claims, Northpoint simply has not demonstrated that its proposed use of the 12.2-12.7 GHz band for terrestrial point-to-multipoint services would not interfere with current and prospective DBS operations. Indeed, Northpoint's most recent tests are incomplete and methodologically unsound, suggesting that the risk of such interference remains high.

Nor is it necessary to use the DBS spectrum for a terrestrial wireless provider to compete against cable. The Commission has already set aside spectrum for ubiquitous or high density terrestrial services such as Northpoint's. The Commission has licensed Multichannel Multipoint Distribution Service providers. Only last year the Commission also auctioned broadband terrestrial spectrum for Local Multipoint Distribution Services, which could be used to compete in the MVPD market if such use proves viable. But where wireless cable in other bands has not proven to be a viable alternative to cable so far, it would be inappropriate for the Commission to allocate the DBS spectrum for yet another wireless cable solution and endanger the integrity of the only service that has proven to be such a viable alternative.

Nor does EchoStar believe that Northpoint would offer an attractive local-into-local complement to satellite services, for the same reason that consumers today find cumbersome the combination of a satellite dish and a terrestrial off-air antenna, and are turned off by such an offering.

For these reasons, EchoStar urges the Commission to reject Northpoint's proposal to permit use of this band for a point-to-multipoint terrestrial service.

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FEDERAL COMMUNICATIONS COMMISSION
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To: The Commission

COMMENTS OF ECHOSTAR COMMUNICATIONS CORPORATION

I. INTRODUCTION

EchoStar Communications Corporation ("EchoStar") hereby submits its Comments on the above-captioned proposals (1) to permit non-geostationary satellite orbit ("NGSO") Fixed-Satellite Service ("FSS") operations in certain segments of the Ku-band, including the 11.7-12.7 GHz band, the 14.0-14.5 GHz bands, and the 17.3-17.8 GHz band; and (2) to permit terrestrial use of the 12.2-12.7 GHz band for the retransmission of local television

and provision of one-way data services on a secondary basis by Direct Broadcast Satellite ("DBS") service operators and their affiliates.[1] These proposals correspond to petitions for rulemakings filed by SkyBridge, L.L.C. ("SkyBridge") and Northpoint Technology ("Northpoint"), respectively.[2] As demonstrated below, absent appropriate technical constraints on the proposed NGSO FSS services beyond those already proposed by the Commission, the proposed allocation would compromise and could significantly interfere with existing DBS and FSS services in the Ku-band, and accordingly, should not be approved at this time. Furthermore, the Commission should not allocate the DBS spectrum to a ubiquitous terrestrial service.

The 12.2-12.7 and 17.3.-17.8 GHz bands are allocated domestically and in Region 2 to the Broadcasting Satellite Service ("BSS") for the provision of DBS services and their associated feederlinks, such as those provided by EchoStar.[3] The 11.7-12.2 and 14.0-14.5 GHz bands are also allocated to the FSS, for which EchoStar also holds licenses. The importance of these services cannot be underestimated. In particular, with over six million subscribers in the United States today using the DBS bands, as the Commission recognizes, DBS is "the closest competitor to the cable television industry for the provision of multichannel video program

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[1] *In the Matters of Amendments of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range and Amendment of the Commission's Rules to Authorize Subsidiary Terrestrial Use of the 12.2-12.7 GHz Band by Direct Broadcast Satellite Licensees and their Affiliates*, Notice of Proposed Rulemaking, ET Docket No. 98-206 (rel. Nov. 24, 1998) ("NPRM").

[2] SkyBridge Petition for Rulemaking, RM-9147 (filed July 3, 1997); Northpoint Petition for Rulemaking, RM-9245 (filed March 6, 1998).

[3] This band is also allocated to the Fixed Service and is used to provide point-to-point microwave service, although all point-to-point FS systems authorized after 1983 must operate on a non-interference basis vis-a-vis DBS. 47 C.F.R. § 101.147(p).

distribution services."[4] Accordingly, it is vital that the Commission protect both the current and future operation of these services. However, neither of the proposals made in this proceeding provide adequate interference protection to existing and proposed satellite services in the United States that are already allocated in these bands.

Accordingly, EchoStar urges the Commission: (1) not to allocate Ku-band spectrum for NGSO FSS services unless or until it can conclusively determine that existing and planned FSS, and, in particular, DBS services are adequately protected and only on the condition that any NGSO FSS system that exceeds the mandated power limits cease operations or reduce signal strength until these limits are met; and (2) to reject outright Northpoint's proposal to permit use of the DBS frequencies for a point-to-multipoint terrestrial service.

II. THE CRITERIA PROPOSED FOR NGSO FSS-DBS SHARING DO NOT ADEQUATELY PROTECT EXISTING AND PROPOSED DBS SERVICES

The NPRM proposes a domestic NGSO FSS allocation in the Ku-band in order to permit NGSO FSS services, such as SkyBridge's, to use the band on a co-primary basis with existing DBS and FSS services.[5] While EchoStar does not object to this allocation in principle, it does object to the proposed sharing criteria. More specifically, the Commission's tentative proposal to use the provisional power limits adopted at WRC-97 would not adequately protect

[4] NPRM, ¶ 55. EchoStar alone serves over 2 million subscribers from four DBS satellites operating at three orbital locations (61.5° W.L., 119° W.L., 148° W.L.) EchoStar soon will launch two additional DBS satellites at 110° W.L. if the Commission approves its proposed merger with News Corp. and the purchase of MCI's DBS authorizations. *See* FCC File No. SAT-ASG-19981202-00093.

[5] NPRM, ¶ 52.

both existing and future DBS and FSS operations in the Ku-band.[6] In particular, in light of the presence of several million ubiquitous receive dishes, NGSO FSS operations in the Ku-band pose a significant risk to DBS operations. Additionally, EchoStar agrees with the Commission's decision not to allocate spectrum for NGSO FSS systems in the 17.3-17.8 GHz band, which is currently allocated for DBS feederlinks.

A. If Adopted, the Provisional WRC-97 Power Limits on NGSO FSS Systems Would Not Protect Current or Future DBS Operations in the United States

If adopted, the provisional WRC-97 power limits would not adequately protect either current or future FSS, let alone DBS, operations in the United States from NGSO FSS interference in the 12 GHz band. EchoStar agrees with the Commission that these limits are inadequate to protect even the smaller 45 cm dishes widely-deployed in this band.[7] Moreover, while EchoStar believes that significant progress was made at the most recent meetings of the JTG 4-9-11 in determining mutually acceptable criteria for these smaller dishes, a number of technical and regulatory questions – discussed in Section D below -- remain to be answered before these criteria can be finalized.

Among other things, the proposed power limits would produce unacceptable levels of interference with the larger DBS dishes commonly deployed in rural and remote areas like Alaska and Hawaii where DBS service is particularly valuable. As demonstrated in the attached Technical Appendix A, there remains significant disagreement on the power limits

[6] NPRM, ¶ 59.

[7] NPRM, ¶ 59.

needed to protect these larger dishes due to the need to tighten the 100% short term limit and the inability of some NGSO FSS systems to meet these limits.

Furthermore, it is likely that, if adopted, the provisional WRC-97 power limits would hinder the evolution of DBS operations. As the NPRM acknowledges, one of the Commission's chief goals is to "ensure flexibility and reliability for existing and future DBS operations."[8] Clearly, the use of the WRC-97 power limits would not accomplish this goal. For example, EchoStar is currently developing a "dual-feed" dish that would afford subscribers access to channels from satellites at two different orbital locations, *e.g.*, at 119° W.L. and 110° W.L.[9] This is a significant innovation, as it will virtually double the channels available to EchoStar's customers – channels that in many cases will carry local programming – without necessitating two dishes.

B. The Provisional WRC-97 Power Limits May Not Adequately Protect GSO FSS Systems in the 11.7-12.2 and 14.0-14.5 GHz Bands

Similarly, the provisional WRC-97 power limits may not adequately protect existing and planned GSO FSS systems operating in the 11.7-12.2 GHz band (downlinks) and the 14.0-14.5 GHz band (uplinks). At this time, EchoStar supports the power limits proposed by the United States for the 11.7-12.2 GHz band at the JTG 4-9-11 meetings in Long Beach.[10]

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[8] NPRM, ¶ 58.

[9] See attached illustration at Appendix C. This service will become a reality once the Commission approves EchoStar's proposed purchase of MCI's authorization at 110° W.L., which will result in DBS satellites only 9° apart.

[10] With regard to the uplink 14.0-14.5 GHz band, EchoStar also supports at this time the power limits proposed by the United States at the Long Beach meetings, including the definition for calculating uplink interference from NGSO FSS earth stations into GSO satellite receive stations.

EchoStar is fully aware that more detailed studies are underway and will be discussed at the March WP4A meeting, and it supports the continuation of the ITU-R work to further develop appropriate power limits that will protect fully existing and planned FSS links in the 11.7-12.2 GHz band.

C. EchoStar Agrees with the Commission's Decision Not to Allocate NGSO FSS Spectrum in the 17.3-17.8 GHz Band

EchoStar agrees with the Commission's decision that "spectrum sharing between ubiquitous BSS downlink to subscriber operations and NGSO FSS uplink operations, both service and gateway links, would not be possible."[11] More specifically, use of the 17.3-17.8 GHz band by NGSO FSS (Earth-to-space) user terminals is simply not feasible in view of the international and proposed domestic allocation of that band to DBS downlinks starting in 2007, as the separation distance between NGSO FSS user terminals and DBS receivers is significant. In addition, the separation distances required between DBS receivers and NGSO FSS gateways could significantly constrain the future development of DBS in the United States. These conclusions reinforce the decisions of WRC-97 not to allocate the 17.3-17.8 GHz band to NGSO-FSS services in Region 2.

D. The Commission Must Not Allocate Spectrum for NGSO FSS Systems in the Ku-Band Until It Is Conclusively Demonstrated that Existing and Proposed DBS and FSS Operations In the United States Are Fully Protected

Rather than simply relying on the provisional WRC-97 power limits, the Commission must instead wait until it is conclusively demonstrated that current and future FSS,

[11] NPRM, ¶ 48.

and even more so DBS, operations in the United States are fully protected before allocating any Ku-band spectrum to NGSO FSS operations. It is simply premature to act now based on the provisional limits and the current work of the JTG-4-9-11 and WP 4A. As set forth in Technical Appendix A, there are many technical and regulatory questions that have yet to be fully answered, such as:

- What will the final power limits be?
- How many NGSO FSS systems will be allowed to operate on a co-frequency basis?
- What if multiple NGSO FSS systems exceed the assumptions made to establish the final power limits?
- What is the regulatory scheme to ensure that not only the single entry epfd limits are met per system, but also that the aggregate epfd levels are not exceeded?
- Will the final limits fully protect existing and planned DBS and FSS services in the United States?
- What if harmful interference to DBS and FSS does occur after NGSO FSS systems are implemented?

Until all of these questions are answered with some degree of certainty, there simply is not an adequate basis to rule on the NPRM's proposals.

E. The Commission Should Require NGSO FSS Systems to Cease Operations or Reduce Signal Strength if the Final Power Limits Are Exceeded

The Commission should explicitly require NGSO FSS systems to cease operations or reduce signal strength if in practice they exceed the power limits ultimately placed on them. In other words, interference from NGSO FSS systems would only be considered "acceptable" so long as they do not exceed the approved power limits. By establishing such a

rule, the Commission would provide DBS operators with some of the necessary assurance that their services will not receive *any* harmful interference from NGSO FSS systems, individually or collectively.[12] Given the uncertainty that surrounds the proposed sharing criteria, and the Commission's emphasis on ensuring that both existing and future DBS services are fully protected, it is entirely appropriate for NGSO FSS systems to bear the burden of operating on such a non-interference basis.

III. NORTHPOINT'S PROPOSED SERVICE IS NOT NEEDED BY DBS LICENSEES AND WILL INTERFERE WITH EXISTING DBS SERVICES

The NPRM also seeks comments on Northpoint's proposal to use the 12.2-12.7 GHz band for its point-to-multipoint terrestrial system.[13] As EchoStar and other DBS operators have previously demonstrated, Northpoint's system would likely interfere with existing DBS services.[14] Northpoint claims that that it would not do so, yet its own test results do not support this claim. As demonstrated in the attached Technical Appendix B, even Northpoint's most recent trials in Austin, Texas do not fully address the concerns already raised by EchoStar and others in response to Northpoint's earlier Petition.[15] At the same time, Northpoint does not present a convincing rationale for putting existing DBS customers at such risk. Northpoint

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[12] This is consistent with the terminology of the International Radio Regulations *See* Final Acts of WRC-97 at S22.2. *See also* 47 C.FR. § 2.1 (accepted interference is "[i]nterference at a higher level than defined as permissible interference . . .").

[13] NPRM, ¶ 95.

[14] *See* Opposition of EchoStar Communications Corporation to Northpoint Petition for Rulemaking, FCC File No. RM-9245 (filed Apr. 20, 1998).

[15] *See generally*, Comments of EchoStar Communications Corporation and Comments of DIRECTV on Northpoint Petition for Rulemaking (filed Apr. 20, 1998).

claims that its technology will enhance competition against cable operators by enabling DBS customers to receive local signals, and will also introduce new, stand-alone competition to cable.[16] However, ample other spectrum is available for Northpoint and other to pursue these stated benefits, and the Commission should not consider jeopardizing the integrity of the DBS spectrum.

A. The Results of Northpoint's Austin Trials Are Flawed

As demonstrated in Technical Appendix B, the results of Northpoint's most recent tests conducted in Austin, Texas do not support its claim that its proposed service will not interfere with DBS reception. Not only are the tests incomplete – they only covered DBS reception from one out of three of EchoStar's orbital locations -- but the methodology used by Northpoint to conduct its tests is flawed.

1. Northpoint's Tests Are Incomplete

Northpoint's tests are incomplete in at least three significant respects. **First**, all the testing contained in its Austin report examined DBS satellite reception only from satellites at 101° W.L. and 119° W.L. No interference tests were conducted for EchoStar's satellites located at 61.5° W.L. or 148° W.L., although live transmissions were active at these locations during the test period. By Northpoint's own admission, a DBS receive system is more susceptible to interference as the LNBF feedhorn is exposed to the Northpoint signal. Given the look angles to 61.5° W.L. and 148° W.L. from Austin, Texas, the likelihood of Northpoint's system causing harmful interference to DBS reception is greater at these untested locations than from 101° W.L.

[16] NPRM, ¶ 91.

and 119° W.L., particularly in a multipath environment. EchoStar has a similar concern with respect to the 175° W.L. orbital location, for which it holds an authorization.

Second, Northpoint's tests only measured one channel per location, assuming that each video channel in the combined data stream on any transponder will be equally affected. This assumption is wrong. For example, one channel may use 5 MBPS for video while another one on the same transponder may use 4 MBPS. In addition, EchoStar employs statistical multiplexing of the video channels such that the allocated bandwidth per program dynamically changes based on content. Thus, not all channels on any given transponder are equally degraded in the presence of interference.

Third, Northpoint's Austin tests did not adequately examine the multipath issue – *i.e.*, interference compounded by reflections off nearby buildings. In particular, Northpoint only observed some 30 test sites. However, the accumulation of interference is specific to each and every Northpoint site. Thus, unless Northpoint intends to do an analysis for every site, it cannot possibly eliminate the potential for significant interference that its service poses to DBS reception in a real-world environment. Indeed, Northpoint's test results indicate that its own services run the risk of interference from its system in a multipath environment.

Moreover, Northpoint's proposed solutions for dealing with such interference are neither economically nor aesthetically acceptable. First, Northpoint suggests installing a DBS antenna design without an offset focal point assembly. However, non-offset antennas can cost three to four times that of the standard 18" offset reflector and LNBF assembly. Thus, the cost of replacing the antennas of even a small fraction of existing DBS customers would be prohibitively expensive. Second, Northpoint suggests placing shielding plates around the DBS antenna to block interference. Such a solution, however, would likely not only offend individual

customers, but may also run afoul of many of the covenant rules and restrictions in place in communities around the country.

In short, Northpoint's tests are incomplete and inconclusive. Without thorough, comprehensive tests, EchoStar simply cannot agree that Northpoint's technology will not significantly interfere with DBS services in the United States.

2. Northpoint's Methodology Is Significantly Flawed

Additionally, Northpoint's methodology is flawed in at least two key respects. **First**, Northpoint's criterion for assessing interference, *i.e.*, whether such interference was "user-detectable," is inadequate. "User-detectable" implies viewing the video for break-up or loss of video. This assumes that the signal can simply be degraded until video is lost. Up until that point, any margin in the system designed to compensate for rain fade and required availability is lost. In other words, Northpoint would essentially deprive EchoStar of all of its rain fade and availability margin. This margin is particularly important for EchoStar's service to, among other locations, the upper Northwest and New England.

Second, Northpoint's method of measuring signal strength degradation is equally flawed. Even Northpoint itself states that the proper method of measuring signal strength degradation is to turn the Northpoint transmitter on and off and compare the signal strength "deltas." Yet Northpoint inexplicably did not follow this method. Rather, it chose to measure the signal strength on adjacent unaffected EchoStar transponders. It then computed the average of these two transponders and assumed that this value was the level of the affected EchoStar transponder without interference present. A ratio was then calculated using the measured signal strength of the affected transponder to the averaged value already computed. Additionally, this

entire analysis assumes that there is some gain slope relationship between transponders on the satellite. Again, this is not the case. Each transponder has its own amplifier and thus each will have different values and, accordingly, different signal strength values. Thus, not only is the method of averaging adjacent transponder signal strength inaccurate, but the ratio calculation is inaccurate as well.

In sum, absent a complete analysis using the proper methodology, it is simply not possible to accept Northpoint's conclusion that its service would not interfere with existing DBS services.

B. Northpoint Cannot Justify Jeopardizing Existing and Future DBS Services

Northpoint cannot justify putting existing and future DBS services at risk. When the Commission first allocated spectrum for high-power DBS services, it made the wise decision to relocate terrestrial microwave operations (except for a few grandfathered links).[17] The DBS allocation is one of the Commission's spectrum management success stories. As the Commission has recognized, there are now well over six million DBS subscribers in the United States, making "DBS the closest competitor to the cable television industry for the provision of multichannel video program distribution services."[18] Northpoint's proposal will jeopardize this competitive position even as it claims to seek to enhance it.

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[17] *See Inquiry Into the Development of Regulatory Policy in Regard to Direct Broadcast Satellites for the Period Following the 1983 Regional Administrative Radio Conference*, Report and Order, 90 FCC 2d 676 (1982).

[18] NPRM, ¶ 55.

Northpoint claims that its technology can provide DBS customers with the local programming they crave. In that respect, the Commission's NPRM requests comments on terrestrial point-to-multipoint use of the 12.2-12.7 GHz band "by DBS licensees and their affiliates."[19] However, such programming would likely come at the expense of the reliability and quality that makes DBS competitive with cable. Such a risk is unnecessary for two reasons. **First**, rapid advances in satellite technology, such as digital compression and EchoStar's own "dual-feed" dish, are enhancing DBS operators' ability to provide more local programming directly to their customers. While there are still certain legal and technical challenges to providing DBS customers with local programming, EchoStar is confident that it will be able to provide the vast majority of its subscribers who want reliable local programming with satellite-delivered services in the near future.

Significantly, DBS licensees – Northpoint's first class of purported beneficiaries – do not believe they will benefit from such terrestrial use of the band. Such a service simply does not make business sense. As demonstrated above, while Northpoint pitches its system as a DBS-enhancing service, it is not. To the contrary, the proposed Northpoint system is likely to degrade the service of existing DBS customers in its unproven efforts to provide them with local programming. The result for DBS operators: dissatisfied customers and decreased competitiveness. Such a result cannot be tolerated.

Second, whether Northpoint plans to complement DBS or to introduce new, stand-alone competition to cable, ample non-DBS spectrum is available for Northpoint and others to pursue these services. The Commission has already set aside other spectrum for

[19] NPRM, ¶ 91.

ubiquitous or high density terrestrial services such as those proposed by Northpoint.[20] Northpoint contends that its use of the 12.2-12.7 GHz band will make its service less expensive to consumers, as it will be able to take advantage of existing DBS equipment.[21] However, such savings are irrelevant if the underlying DBS service is degraded. And, as demonstrated above, the risk of such service degradation is quite high. Moreover, any savings would evaporate if DBS customers were required to install non-offset antennas to alleviate interference problems resulting from Northpoint's services.

Third, given that Northpoint's service is likely to interfere with existing DBS services, it is equally if not more likely that its service will significantly hamper the ability of DBS providers to implement valuable innovations. For its part, EchoStar is looking not only to implement its dual-feed DBS dish, but also to implement a dual-band DBS/FSS dish. Such innovations are critical to EchoStar's ability to provide consumers with competitive services. However, EchoStar may not be able to deploy these innovations if faced with increased interference from Northpoint's proposed system.

Finally, EchoStar notes that Northpoint seems to have changed its emphasis from a service complementing DBS services to a stand-alone MVPD service. EchoStar welcomes more competition in the MVPD market, and Northpoint can try to compete from any of the terrestrial bands allocated by the Commission for that purpose, including the MMDS and LMDS

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[20] NPRM, ¶ 93. Moreover, Northpoint should not be allowed to benefit from failing to participate in the recent LMDS auctions by acquiring access to Ku-band spectrum for free. Instead, it should be required to bid for the remaining LMDS licenses to be auctioned soon by the FCC if it really wants to get into this business.

[21] *Id.*

spectrum. But where wireless cable has so far not proven to be a viable alternative to cable television, the Commission should not consider one more wireless cable allocation in the DBS band and, in the process, endanger the integrity of the only service that ***has*** proved to be a viable competitor to cable.

IV. CONCLUSION

In light of the foregoing, EchoStar requests that the Commission (1) not allocate Ku-band spectrum for NGSO FSS unless or until it can conclusively determine that existing and planned DBS and FSS services are fully protected and only on condition that any NGSO FSS system that exceeds the mandated power limits cease operations or reduce signal strength until these limits are met; and (2) reject Northpoint's proposal to permit use of the Ku-band for a point-to-multipoint terrestrial service.

Respectfully submitted,

EchoStar Communications Corporation

By: Colleen Sechrest

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Dated: March 2, 1999

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this pleading, that I have either prepared or reviewed the engineering information submitted in the pleading, and that it is complete and accurate to the best of my knowledge and belief.

Paul Langer
Manager of RF Engineering
EchoStar Communications Corporation
Product Division

Dated: March 2, 1999

CERTIFICATE OF SERVICE

I, Colleen Sechrest, do hereby certify that a copy of the foregoing has been sent, via hand delivery, on this 2nd day of March, 1999 to the following:

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Colleen Sechrest

A

Appendix A

NGSO EPFD Limits in the BSS 12.2 – 12.7 GHz Band

As was demonstrated in the US input, Document JTG 4-9-11/321, to the Long Beach JTG meeting the provisional limits adopted by WRC-97 in the 12.2 – 12.7 GHz band for Region 2 are not adequate to protect Region 2 DBS service. Although EchoStar is not opposed to NGSO operations in this band in principle it is unacceptable for NGSO systems to operate in such a manner that they would impact the provision of DBS services to consumers.

Criteria, Methodology and Proposed EPFD Limits

JWP10-11S has adopted a Preliminary Draft New Recommendation (PDNR), "Protection of the Broadcasting Satellite Service in the 12 GHz Band and Associated Feeder Links in the 17 GHz Band from Interference Caused by NGSO FSS Systems". This recommendation specifies the criteria for protection of the BSS service in the 12 GHz band from NGSO FSS interference. EchoStar supports the criteria adopted in this recommendation with the modification agreed to at the Long Beach JTG 4-9-11 meeting[1]. In order to determine the required protection for the BSS service, EchoStar supports applying this criteria to all the Region 2 link budgets contained in the ITU-R BSS sensitive link budget database, including additional links provided to the ITU by 15 March 1999. EchoStar also supports the methodology defined in the PDNR and supports the implementation and software developed and presented in the US Document JTG 4-9-11/321. At the JTG meeting it was agreed that the software implementation of the methodology in the US document was correct. Following are EchoStar's proposed aggregate epfd values for the 12.2 – 12.7 GHz band in Region 2 to protect the BSS service. These are the same limits proposed in Document JTG 4-9-11/321. The details of the analysis are not repeated here as they are described in full in Document JTG4-9-11/321.

Proposed Aggregate Mask, 45 cm Antenna, Region 2

Aggregate Mask All NGSO Systems	
Epfd DBW/m^2/4kHz	P (X<epfd), %
-178.8	98.96%
Slope = -12.5 dB/decade to –166.1	
-166.1	99.90%
-166.1	100%

[1] The proposed change is that BSS is to be protected against the onset of "freeze frame" instead of sync loss in recommends 1.2 of the PDRN.

Proposed Aggregate Mask, 60 cm Antenna, Region 2

Aggregate Mask All NGSO Systems	
Epfd DBW/m^2/4kHz	P (X<epfd), %
-182.3	99.00%
Slope = -12.5 dB/decade to –169.8	
-169.8	99.90%
-169.8	100%

Proposed Aggregate Mask, 90 cm Antenna, Region 2

Aggregate Mask All NGSO Systems	
Epfd DBW/m^2/4kHz	P (X<epfd), %
-184.8	99.24%
Slope = -12.5 dB/decade to –173.8	
-173.8	99.90%
-173.8	100%

Proposed Aggregate Mask, 120 cm Antenna, Region 2

Aggregate Mask All NGSO Systems	
Epfd DBW/m^2/4kHz	P (X<epfd), %
-186.5	99.38%
Slope = -12.5 dB/decade to –176.6	
-176.6	99.90%
-176.6	100%

Proposed Aggregate Mask, 180 cm Antenna, Region 2

Aggregate Mask All NGSO Systems	
Epfd DBW/m^2/4kHz	P (X<epfd), %
-189.2	99.21%
Slope = -12.5 dB/decade to –178	
-178	99.90%
-178	100%

As described in JTG 4-9-11 document 321 the proposed shape of the aggregate epfd mask is continuous curves rather than specific points as set out in the provisional WRC-97 limits. The shape of the mask was designed in order to accommodate the requirements of NGSO FSS systems such as SkyBridge.

Aggregate and Single Entry EPFD Limits

In order to convert from aggregate to single entry EchoStar supports recommendation 2.2 in the JWP10-11S PDNR which states:

> that the apportionment of the aggregate interference allowance specified in recommends 1.1 and 1.2 to derive single entry limits be based on the number of NGSO FSS systems that are anticipated to share the same frequency bands;

EchoStar agrees and supports the methodology described in JTG Document 321 for deriving single entry epfd curves from aggregate epfd curves.

EchoStar believes that it is essential for the Commission to adopt an aggregate epfd limit as well as single entry epfd limits. The aggregate epfd limit is what would fully protect GSO systems from interference from NGSO FSS systems. Document 4-9-11/TEMP/77 recognized that in deriving the final value of N (to be used to assess the interference from multiple NGSO FSS systems in GSO systems) regulatory mechanisms must be developed to ensure that the aggregate epfd limit is never exceeded. The aggregate epfd limit may be exceeded if the number of deployed NGSO systems exceeds N and each system causes an interference level to the GSO equal to a full single entry epfd limit. It does EchoStar no good to have single entry limits based on a specific N and an aggregate epfd that protects the BSS service if the number of NGSO systems deployed exceeds N and their combined interference exceeds the aggregate epfd limit. Therefore the Commission must ensure that the aggregate epfd limit is never exceeded.

Completion of ITU-R Technical Examination

EchoStar recognizes that no agreement on epfd levels in the 12.2 –1 2.7 GHz band for Region 2 has been reached by the ITU-R groups addressing this subject and that JWP10-11S has been requested by JTG 4-9-11 to continue the work and reach agreement on the proposed epfd limits. EchoStar realizes that the protection criteria defined in the JWP10-11S PDNR can be met by variations in the above proposed epfd masks for a given BSS system and a given antenna size. We are not opposed to modifications to the above epfd curves as long as they meet the criteria defined in the JWP10-11S PDNR for all Region 2 links in the ITU-R BSS link budget database. This includes additional link budgets that BSS operators, including EchoStar, will be providing to the ITU through their Administrations.

It is the belief of EchoStar that consensus will be reached on the smaller 45 cm and 60 cm size dishes. However, there is significant disagreement on the epfd limits for the larger size dishes due to the need to tighten the 100% short term limit and the difficulties by some NGSO systems, e.g. LEOs, to meet the tighter 100 % short term limits. It is important to recognize that some of the recent Ku-band NGSO FSS filings to the Commission employ mitigation techniques, which more fully protect GSO systems. The tighter limit is required to protect larger BSS receive dishes, using the criteria defined in the JWP10-11S PDNR, from losing freeze frame. These larger size dishes are deployed in Alaska, and certain western areas of the US. These larger size dishes would also be deployed in Puerto Rico and the US Virgin Islands where the eirp may be lower than that provided over the contiguous US. As the FCC has recognized, provision of DBS services to these areas are very important and in the public interest and need to be equally protected.

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ECHOSTAR TECHNOLOGIES CORPORATION
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February 23, 1999

Steptoe and Johnson, LLP
1330 Connecticut Avenue, N.W.
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Attn: **Colleen Sechrest**

RE: **Comments on DCE's Northpoint Progress Report on DBS Compatibility in Austin, TX**

Diversified Communication Engineering, Inc. [DCE] has obtained an experimental FCC license to broadcast on the 12.2 GHz to 12.7 GHz frequency band from terrestrial sources. This is the same frequency that EchoStar uses for DBS transmissions from multiple satellite locations. DCE claims their system will not cause interference to current DBS customers. These tests were conducted in Austin, Texas in December 1998. An engineering progress report was completed and submitted to the FCC on January 20th, 1999.

Summary

The Northpoint report is incomplete. All the testing contained in this report covered DBS satellite reception from 101W and 119W locations only. No tests for interference were performed for satellites at 61.5W and 148W although live transmissions were active at these locations at the time of the test. By Northpoint's own admission, the DBS receive system is more susceptible to interference as the LNBF feedhorn is exposed to the Northpoint signal. Given the look angles to 61.5W and 148W, the opportunity for interference will be increased for these locations. Include the fact that multipath interference exists and was observed by Northpoint, these additional locations must be tested in the presence of multipath. Without test data for these locations, the report is incomplete.

The Northpoint report has a flawed analysis. One of the main arguments for the level of interference seen is derived from signal strength indicators. Northpoint suggested the proper method of measuring signal strength degradation by turning their transmitter on and off and comparing the signal strength deltas. Instead, Northpoint chose to measure the signal strength on adjacent unaffected transponders. They computed the average of these two and assumed that this value was the level of the affected transponder without interference present. A ratio was then calculated using the measured signal strength of the affected transponder to the averaged value already computed. This entire analysis assumes that there is some gain slope relationship between transponders on the spacecraft. This is not the case. Each transponder has its own amplifier and thus each will have different EIRP values and subsequently different signal strength values. Not only is the averaging of adjacent transponder signal strength in error, the ratio calculation is also in error. The proper method is to measure the affected transponder with the Northpoint transmitter off and then with it on to compare signal strength values.

The EchoStar test data indicate multiple instances where the DBS receive system was blocked or partially blocked by obstructions. Out of 30 sites tested, seven sites had comments that the EchoStar antenna sighted 'through a pecan tree' or 'through power lines' or even 'through a house'. The installation manuals for either DBS system refer to finding a clear line of sight to receive the best signal strength possible. Therefore, these locations where some blockage was reported would not be typical

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installation locations and the data derived from these sites should not be considered relative to the report.

The Northpoint report demonstrates that interference is present. While no complete loss of signal was found, Northpoint stated that some level of interference was present. This report may have focused on interference to DBS systems, but data shows that even a Northpoint system is subject to interference from the transmitter due to multipath problems. No signal strength degradation data was presented on Northpoint to Northpoint interference levels. As suggested by Northpoint, use of shielding plates or alternate antenna technology may be used to minimize interference. Either solution will create a burden for existing and future customers in time and money. Use of shielding plates will also have aesthetic problems in the 'look and feel' of the construction, which may cause many customers to reject this alteration to an existing installation.

Specific Comments on Progress Report filed January 20, 1999:

- **"... no beam tilting or other mitigation techniques were required to achieve the positive results report herein." Page 6.**

  This provides no indication that tilting the beam will not create interference. Any beam tilting will further change all the reflection angles for multi-path interference. As suggested previously, Northpoint considers pointing the beam downward to mitigate interference.

- **"To include test sites which appear to present extreme or worst case interference conditions", Page 6.**

  This statement is inconsistent with the rest of the data. To consider all worst case conditions then all satellite positions and their corresponding look angles must be considered. For this test, only DirecTV and EchoStar at 101W and 119W were tested. No testing was performed for 61.5W and 148W where EchoStar has satellites with live transmissions. There is no reason why these were not also tested to provide complete set of data.

- **"... an alternate error assessment was first suggested by USSB personnel, based on the DBS software 'signal strength pointer' (ssp) that is provided for use in peaking the DBS antenna." Page 7.**

  EchoStar also has a signal strength pointer indicator. The level indicator in percent is directly related to the received C/N levels at the receiver. Typical slope is 5% per 1 dB of Eb/No. Lowest signal lock level is approximately 30%.

- **"... there was no user-detectable DBS interference at any site of the survey. ... An expected small influence on the DBS error rate was observed, as indicated by the DBS signal strength pointer scheme, for sites located in the 'maximum interference' zones..." Page 9.**

  User-detectable implies viewing the video for break-up or loss of video. This is a poor criteria as this assumes that you can simply degrade the signal until video is lost. Up until that point, any margin in the system designed to compensate for rain fade and required availability is lost.

  By their admission, the Northpoint signal does affect the receiver and is degrading the received signal to noise levels.

- **"The transmitter was operated with a carrier frequency of 12.470 GHz modulated to produce a symmetrical modulation bandwidth of 8 MHz." Page 14.**

As stated in previous comments, testing of a singular 8 MHz interference is not representative of a real world system. If a fully deployed system were implemented, it is likely that a wider modulation rate or multiple carriers will occupy the 24 MHz currently occupied by satellite transmissions. Once again, Northpoint has no proposal on the format and allocation of signals in a terrestrial 12.2 to 12.7 GHz broadcast. Use of a single modulated carrier will tend to underestimate the amount of system degradation due to interference.

- **"The indicated TV channels were monitored to observe the received signal integrity. Although other known TV channels are related to the same transponder, all related channels are affected if any one is; thus, only one channel needed to be monitored." Page 15-16.**

  This assumption is flawed in that each video channel in the combined data stream on any transponder will be equally affected as implied here. For example, one channel may use 5 MBPS for video while another on the same transponder may use 4 MBPS. In addition, EchoStar employ statistical multiplexing of the video channels such that the allocated bandwidth per program dynamically changes based on content. Therefore, not all channels on any given transponder are equally degraded in the presence of interference.

- **"It is further observed that setup instructions for DBS consumer systems normally specify a pointer value of 60, or so, as the lower threshold for a suitable antenna setup." Page 17.**

  For any installation, the consumer is required to peak the antenna for<u>maximum</u> signal strength not just to 60 percent. An installation that is setup to achieve only 60 percent will suffer greater signal loss during rain fade due to lower C/N due to mispointing of the antenna.

- **"An obvious test approach would be to observe the ssp [signal strength pointer] values with the NP-Tx signal both off and on. While this was done for some early tests, it was found that similar results could be obtained by leaving the NP-Tx on and comparing the ssp values for transponder T18 with other even numbered transponders that were away from the NP frequency band and not affected by NP. For the ssp recording scheme employed in the survey data reported herein, a sampled array of 10 ssp readings for each of the transponders T16, T18, and T20 is recorded, with values read at approximately 1 second intervals." Page 17-18.**

  This entire method for calculating the interference level is flawed. This derivation assumes that the transponders #16 and #20 are equal in ssp to #18. On the satellite, each transponder has slightly different output power and thus different EIRP. The low noise frequency block downconverter with integrated feedhorn [LNBF] will not have constant noise figure for all transponders. Due to these individual variations, the <u>only</u> way to determined the effect on signal strength indicator is to record values with the NP-Tx ON and then with it OFF. Northpoint apparently chose to simplify the test and reduce testing time and thereby introduced serious flaws into the data calculations. Given that this report relies on the ssp data and derived pdix values, any conclusions will be questionable.

- **"Reference ssp value - sspo = (ssp(T16) + ssp(T20))/2" Page 18.**

  Given that each transponder EIRP is independent of any other transponder plus other receive system variations renders this equation invalid. It assumes there is some linear function in power levels based upon the levels of transponder 16 and 20.

- **"Pointer Depression Index – pdix = ssp(T18)/sspo" "The pdix value decreases with depression of the ssp values for T18, the target transponder." Page 18.**

Again, each transponder output EIRP is independent of any other transponder. This equation is flawed. Even without interference, the pdix value may be less than or greater than 1.00 just due to inherent and independent variations in the spacecraft and receive system variables.

- **"(3) Point DBS antenna to EchoStar satellite and acquire signal;" page 19.**

  Only satellite reception from 119W was tested for interference. No tests were completed for 61.5W or 148W. Therefore, the test data is incomplete.

- **"And while evidence of increased signal error rate was indicated by the ssp data for 3 or so close range sites, the error rate influence appeared to be small, since the worst case pointer depression index (pdix) was 0.83" Page 21.**

  Northpoint's transmitter does affect receiver sites. For sake of argument, let us assume that a pdix of 0.83 was valid. Assume further that the 'no interference' signal was 90% which was typical of clear sky signal strength. With the interferer, the new value is now 74%. Given the delta of 16%, this indicates approximately 3 dB loss in received C/N. This translates to a much degraded loss in rain fade margin.

- **"It should be noted here that even in the worst case example, the ssp value did not fall below the suggested minimum signal strength." Page 21.**

  The minimum signal strength is where there is minimum margin in the received signal. This cannot be used as the criteria for the amount of acceptable interference.

- **"An experiment to test the effectiveness of shielding was conducted close in to the NP transmitter. The test was conducted by using a small aluminum plat to shield the DBS antenna feed horn assembly from the NP signal and demonstrated the interference in this near range zone is easily reduced to near zero (pdix near 1.0). It is also evident that the interference is largely due to a condition where the DBS antenna feed horn LNB input is directly exposed to the NP signal, i.e. not blocked by either the dish or its orientation. The interference of this nature is easily remedied with minimal shielding as was shown or by selecting an antenna design without an offset focal point assembly.**

  This clearly shows that all look angles for satellite reception must be tested, i.e. 61.5W and 119W. The Northpoint progress report is incomplete and inconclusive as they chose to ignore these satellite locations. Use of a shielding plate is unacceptable to customers especially given the growing the number of covenant rules and restrictions in place today. While a customer has a right to install an antenna, does this extend to installing additional metal plates around the antenna? Finally, suggesting that a different antenna design without an offset assembly is also unacceptable. With over 2 million customers in the field, the cost of replacing the antennas is prohibitive.

- **"Evidence of NP-DBS error rate influence is apparently small and if interference were to affect a close-in user it can be essentially eliminated by simple measures." Page 23.**

  This is unacceptable to a customer. Installations of metal plates to block signals are aesthetically offensive. A non-offset antenna implies a planar array assuming approximately the same reflector size. These antennas can cost three to four times that of the standard 18" offset reflector and LNBF assembly.

- **"Although one or more reflections were observed at most of the near range sites by intentionally scanning with the DBS antenna, they were usually small and there was no observed negative influence that could be attributed to them." Page 23.**

Only satellite locations at 101W and 119W were considered while there is no mention of 61.5W or 148W.

- **"... drive the instrument van slowly to the NW across the Palmer parking lot ... while an operator continuously scanned for any possible reflections." Page 24.**

  A better method would be to establish a test path with equally spaced points. At each point, rotate the antenna through look angles from 61.5W to 148W. Moving the van and scanning the antenna simultaneously likely missed some reflections.

- **"Clearly, in two of these cases, the reflected signal was larger than the NP direct signal. A perfectly good NP TV signal was of course found to be available via the reflection, as well as for the direct NP signal in all cases." Page 24.**

  While this report considers interference to DBS providers, this statement clearly indicates that the Northpoint system itself will be subjected to its own interference via multipath. Today's low cost consumer level QPSK demodulator ICs do not include equalizers to compensate for multipath like those for QAM or VSB systems. Therefore, a Northpoint receive system will likely require a metal plate shield or alternate antenna with higher directivity. In some cases, the reflected signal was over 14 dB higher than the direct signal. As a final consideration, where do you tell the customer to point their Northpoint antenna given a multipath environment?

- **"From the test experiences, it appears to be likely that the reflected signals of significant energy are normally fairly well defined (as opposed to highly diffuse and scattered), and there is only a very small probability that a reflected signal of importance would enter the DBS antenna from an angle within the main beam." Page 25.**

  Given only 30 test sites and only consideration for 101W and 119W reception leaves this as a questionable statement. Again, Northpoint must consider 61.5W and 148W locations.

- **"However, in all cases and without any mitigation techniques, the ssp value was still above the recommended threshold given in the installation manual, and thus never impacted the margin required for reception." Page 28.**

  Again, any DBS installation requires you to peak for maximum signal strength to ensure rain fade performance.

- **"Used pie pans to shield N.P. Saw an increase in ssp on meter(TV) 79->85 (ESTAR)." Rx Site Data Log for Site No. 4.**

  A 6% degradation indicates over 1 dB Eb/No degradation. This is a significant level given the rain margins for the system.

- **Rx Site No. 5 data log does not show if EchoStar reception was ok. No other comments related to why EchoStar data was not taken at this site.**

- **Rx Site No. 9 data log shows ssp data for EchoStar in the 65% range. "Through pecan tree, power lines through direct peak"**

  A customer would not typically install an antenna siting through trees and other obstructions. The installation manuals clearly show a clear line of sight is needed for reception. Given that the ssp values are 65% or so, there is minimal rain fade performance and thus the customer will suffer lower availability.

In addition, given the winter time frame of the test when the seasons change to spring the tree will leaf out which may completely block the signal and result in no signal at all.

- **Rx Site No. 12 data log in relating to ssp values - "lower # is with Dr. Word in Boom, Top is without him."**

  The other Rx site data logs make no mention if someone is in the boom or not. Were the other data logs with or without someone present in the boom of the truck?

- **Rx Site No. 13-9 data log - "Estar pointing right through trees, DTV no pointing into trees."**

  Another site where a customer would not typically install an antenna due to line of sight problem.

- **Rx Site No. 13-9-2 data log - "Estar point right through a tree (little one)"**

  Another site where a customer would not typically install an antenna due to line of sight problem.

- **Rx Site No. 14 data log - "Estar had edge of west end of build in its way"**

  Another site where a customer would not typically install an antenna due to line of sight problem.

- **Rx Site No. 15 data log - "Site -15, Estar with spikes."**

  Source of energy referenced on spectrum analyzer unknown. Was this energy generated externally or by the test equipment used during the testing?

- **Rx Site No. 16 data log - "wind moves boom around"**

  SSP data shows variations of 2 to 3% or approximately 0.5 dB in Eb/No. The 3 dB beamwidth of the 18" reflector is approximately 3.7 degrees. This data should be rejected due to boom movement and subsequent variation in ssp data that skews the pdix calculation.

- **Rx Site No. 21 data log - Plot 21-N shows spectrum analyzer was not powered on sufficient time. Note the 'OVEN COLD' on the plot.**

- **Rx Site No. 22 data log - "Estar point through Power Lines and Bldg."**

  Another site where a customer would not typically install an antenna due to line of sight problem.

- **Rx Site No. 25 data log - "Note: Pointing through house and power wires"**

  Another site where a customer would not typically install an antenna due to line of sight problem.

- **Rx site No. 7 location log - "Noted EchoStar signal affected by lightpole, moved 4' to west and repeated EchoStar data."**

  Why is it in this case the testers chose to correct the line of sight problem and not on previously mentioned sites?

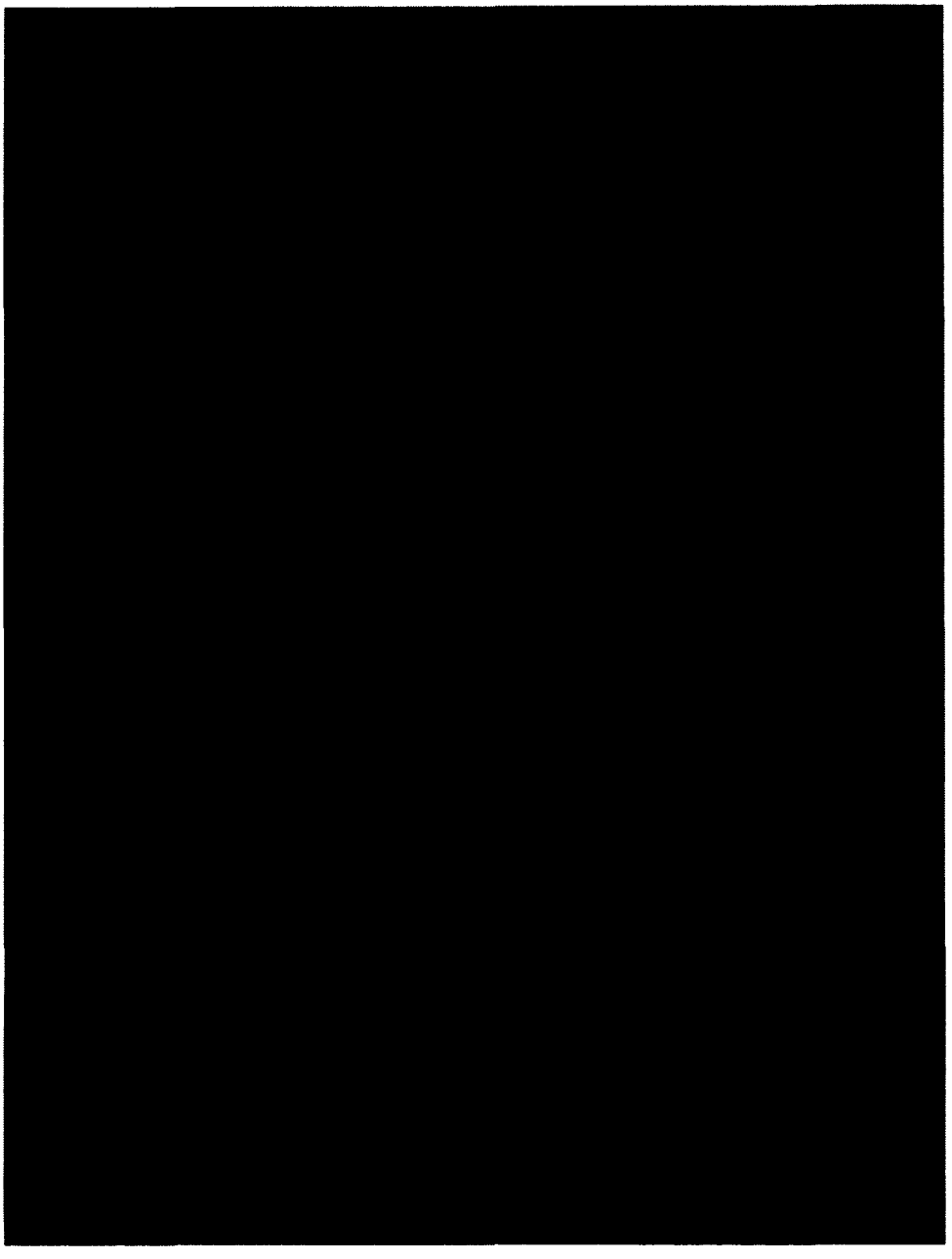
Sincerely,

Paul A. Langer
Manager of RF Engineering

Cc: Mike Dugan, President of EchoStar Technologies Corp.
David Moskowitz, Senior VP and General Counsel of EchoStar Communications Corp.
Ed Allwein, Vice President of Engineering of EchoStar Technologies Corp.

C

Appendix C



Attachment A

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